

WHAT IS CLAIMED IS:

1. An adjustably opaque window comprising:

- a) an external pane;
- b) an internal pane;
- c) a light transmission control layer; and
- d) a shock absorbing layer;

wherein the external pane and the internal pane provide a cavity between them, wherein the light transmission control layer and the shock absorbing layer are positioned in the cavity, wherein the light transmission control layer is supported by the shock absorbing layer.

2. The adjustably opaque window of claim 1, wherein the shock absorbing layer comprises a first flexible sheet, and the light transmission control layer is attached to the first flexible sheet.

3. The adjustably opaque window of claim 2, wherein the first flexible sheet is made of polyester, or polycarbonate.

4. The adjustably opaque window of claim 2, wherein the thickness of the first flexible sheet is in a range from about 0.1 to about 0.2 mm.

5. The adjustably opaque window of claim 2, wherein the external pane and the internal pane are substantially hard.
6. The adjustably opaque window of claim 5, wherein the external pane and the internal pane are made of glass.
7. The adjustably opaque window of claim 2, wherein the light transmission control layer comprises a plurality of light transmission control cells.
8. The adjustably opaque window of claim 7, wherein the light transmission control cells are arranged to form a lattice.
9. The adjustably opaque window of claim 7, wherein the opacity of the light transmission control cells is variably adjustable.
10. The adjustably opaque window of claim 9, wherein the opacity of each of the light transmission control cells is adjusted by changing amplitude of electric field applied on the light transmission control cell.

11. The adjustably opaque window of claim 9, wherein each of the light transmission control cell comprises a first electrode, a second electrode, and an electro-optic material in between the first and second electrodes.

12. The adjustably opaque window of claim 11, wherein the electro-optic material comprises liquid crystal, or nonlinear optical material.

13. The adjustably opaque window of claim 12, wherein the liquid crystal comprises dichroic dye doped liquid crystals.

14. The adjustably opaque window of claim 12, wherein the liquid crystal comprises nematic liquid crystals with chiral dopants.

15. The adjustably opaque window of claim 12, wherein the liquid crystal comprises nematic liquid crystals without chiral dopants.

16. The adjustably opaque window of claim 12, wherein the liquid crystal comprises chiral nematic liquid crystals.

17. The adjustably opaque window of claim 12, wherein the liquid crystal comprises polymeric liquid crystals.
18. The adjustably opaque window of claim 12, wherein the liquid crystal comprises ferroelectric liquid crystals.
19. The adjustably opaque window of claim 12, wherein the liquid crystal is doped with dichroic light absorbing dye.
20. The adjustably opaque window of claim 12, wherein the liquid crystal is doped with pleochoric light absorbing dye.
21. The adjustably opaque window of claim 12, further comprising a first polarizing layer that is positioned between the external pane and the light transmission control layer, and a second polarizing layer that is positioned between the first flexible sheet and the interior pane; wherein the direction of polarization of the first polarizing layer is substantially perpendicular to the direction of polarization of the second polarizing layer.

22. The adjustably opaque window of claim 21, wherein the first polarizing layer is integrated with the external pane, and the second polarizing layer is integrated with the internal pane.

23. The adjustably opaque window of claim 21, wherein the first polarizing layer is absorptive.

24. The adjustably opaque window of claim 21, wherein the first polarizing layer is birefringence based.

25. The adjustably opaque window of claim 21, wherein the light transmission cell further comprises a first electrode that is substantially adjacent the first polarizing layer, and a second electrode that is substantially adjacent the first flexible sheet, wherein the liquid crystal is positioned between the first electrode and the second electrode.

26. The adjustably opaque window of claim 25, wherein the first electrode comprises a substantially transparent plastic substrate coated with transparent conductive coating, and wherein the second electrode comprises a

substantially transparent plastic substrate coated with transparent conductive coating.

27. The adjustably opaque window of claim 25, wherein the surface of the first electrode, which is adjacent the liquid crystal, is treated with a first polymer layer such that the first polymer layer gives a preferential alignment to the adjacent liquid crystal, and the surface of the second electrode, which is adjacent the liquid crystal, is treated with a second polymer layer such that the second polymer layer gives a preferential alignment to the adjacent liquid crystal.

28. The adjustably opaque window of claim 27, wherein the liquid crystals adjacent the first and second polymer layers are pre-tilted from the planes of the first and second polymer layers, wherein the preferential direction of the treated first polymer layer is substantially parallel to the direction of polarization of the first polarizing layer, and the preferential direction of the treated second polymer layer is substantially parallel to the direction of the second polarizing layer.

29. The adjustably opaque window of claim 28, wherein the pre-tilting angle is in a range from 0° to about forty five degrees (45°)°.

30. The adjustably opaque window of claim 29, wherein the pre-tilting angle is about thirty degrees (30°)°.

31. The adjustably opaque window of claim 25, wherein the light control transmission cell further comprises a plurality of spacers, wherein the spacers maintain predetermined distance between the first and second electrodes.

32. The adjustably opaque window of claim 31, wherein all of the spacers are coated with adhesive.

33. The adjustably opaque window of claim 31, wherein part of the spacers are coated with adhesive.

34. The adjustably opaque window of claim 31, wherein the spacers are randomly distributed within the light transmission control cell.

35. The adjustably opaque window of claim 31, wherein each of the spacers comprises a sphere, and the sphere contacts the first and second electrodes.

36. The adjustably opaque window of claim 35, wherein the sphere is coated with an adhesive layer, wherein the diameter of the sphere is in a range from about five (5) to about thirty (30) microns, and wherein the thickness of the adhesive layer is less than about five (5) microns.

37. The adjustably opaque window of claim 9, wherein the first flexible sheet is coated with transparent electrically conductive coating.

38. The adjustably opaque window of claim 37, wherein the transparent conductive coating is made of Indium Tin Oxide.

39. The adjustably opaque window of claim 37, wherein the transparent conductive coating forms an electrical wiring to each light transmission control cell.

40. The adjustably opaque window of claim 39, further comprising a control circuit that controls each of the

light transmission control cells individually with the electrical wiring.

41. The adjustably opaque window of claim 39, further comprising a control circuit that controls the light transmission control cells collectively in part with the electrical wiring.

42. The adjustably opaque window of claim 39, further comprising a control circuit that controls the light transmission control cells in whole with the electrical wiring.

43. The adjustably opaque window of claim 9, further comprising a light sensor that measures the intensity of the incident light, wherein the control circuit controls the light transmission of the light transmission control cells based on data provided by the light sensor.

44. The adjustably opaque window of claim 9, wherein the light transmission of the light transmission control cells is controllable manually.

45. The adjustably opaque window of claim 9, further comprising an array of photovoltaic cells, wherein the array provides electricity for operation of the light transmission control layer.

46. The adjustably opaque window of claim 45, wherein the adjustably opaque window is a vehicle window, and wherein the array is installed in a vehicle.

47. The adjustably opaque window of claim 9, wherein the adjustably opaque window is an architectural window, a glass door, or a partition.

48. The adjustably opaque window of claim 9, further comprising an ultra violet light blocking layer that is positioned between the exterior pane and the light transmission control layer.

49. The adjustably opaque window of claim 2, wherein the opacity of the light transmission control layer is variably adjustable.

50. The adjustably opaque window of claim 49, wherein the opacity of the light transmission control layer is adjusted

by changing amplitude of electric field applied on the light transmission control layer.

51. The adjustably opaque window of claim 2, wherein the shock absorbing layer further comprises a second flexible sheet, wherein the second flexible sheet is attached to the light transmission control layer opposite to the first flexible sheet.

52. The adjustably opaque window of claim 1, wherein the shock absorbing layer comprises gel that fill the cavity, and the light transmission control layer is supported in the gel.

53. The adjustably opaque window of claim 1, wherein attachment among the external pane, the internal pane, the light transmission control layer, and the shock absorbing layer is done with pressure sensitive adhesive.